RECREATIONAL BOATING NEEDS ASSESSMENT AND EXPANSION FEASIBILITY STUDY FOR THE TIDAL WATERS OF NEW HAMPSHIRE

A Recreational Boating Inventory and Assessment
Facilities, Needs, Opportunities and Constraints

EXECUTIVE SUMMARY

Submitted to the New Hampshire
State Port Authority
by

Arthur D. Little, Inc.

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EXECUTIVE SUMMARY

A. Background

New Hampshire has roughly 18 miles of coastline on the Atlantic Ocean between Massachusetts to the south and Maine to the north. Although much of this coast consists of unprotected beaches or rocky shoreline exposed to the ocean, there are seven areas of significant recreational boating activity accommodating about 1350 boats on slips (450) and moorings (900) and an additional 10,000 boat launches per year at 15 boat ramps. These facilities are identified by harbor in Table S-1 and Figure S-1. These facilities have come under increasing pressure in recent years as New Hamsphire's population has grown and as the popularity of recreational boating has increased. In the past five years waiting lists have become commonplace at both marinas and mooring areas with waiting times of several years reported in the more popular areas (especially Rye, Little Harbor, New Castle and Portsmouth).

These demands are anticipated to continue to increase at the rate of 3.5% to 6.0% per year over the next ten years. This would result in a combined demand for 2400-3000 additional slips and moorings in 1990. The New Hampshire coastline has limited amounts of protected waters with more than 6 feet of depth. There are also a large number of boating constraints (bridges, currents, rocks, etc.) as well as many competing demands for waterfront use. Consequently, a careful strategy must be charted for the 1980's if the saltwater boating needs to New Hampshire's residents are to be adequately met.

Table S-1

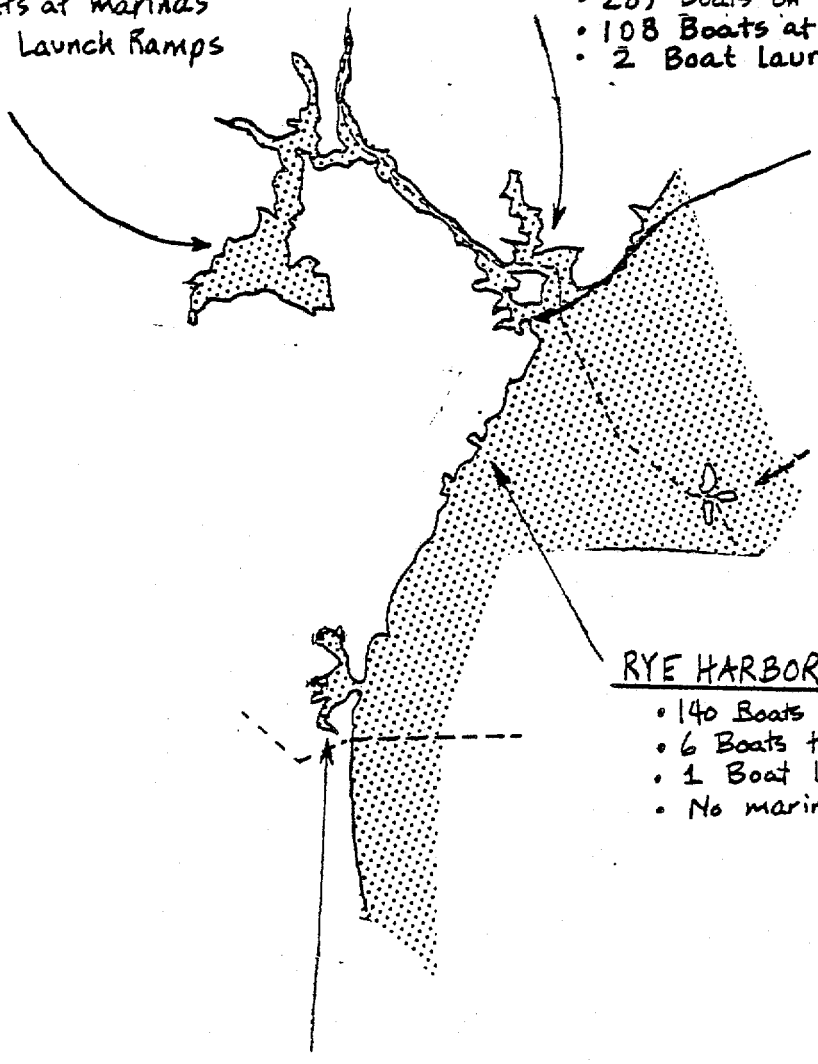
Current and Proposed Recreational Boating Facilities
on the New Hampshire Coast

	Total	Hampton/ Seabrook	Rye	Little Harbor	Sagamore Creek/ Back Channel	Piscataqua River	Great and Little Bays
Current Facilities							
Moorings	883	245	140	50	25	264	159
Mooring Wait List*	257	85	146	142	142	142	26
Marina Slips	370	130	6	1	85	23	128
Boat Ramps	15	6	1	1	0	2	5
Recommended Improvements							
Phase I Improvements (1981-1984)	+ 1 ramp +518 moorings	+45 moorings	+ 1 ramp +18 moorings	+1 ramp (res) +139 moorings	+1 ramp +186 moorings	+30 moorings	+100 moorings
Phase II Improvements (1984-1987)	+500-700 slips		+283 slips	+183-337 slips		+30-40 slips	
Resulting Facilities (1987)							
Moorings	1401	290	158	189	211	294	259
Marina Slips	862-1026	130	289	183-337	85	50-60	125
Boat Ramps	17	6	2	1	1	2	5

*Some people have put themselves on more than one waiting list. For this reason, the total of the breakdown by harbor exceeds the total of 257.

NEW HAMPSHIRE SEACOAST

FACILITIES INVENTORY



GREAT & LITTLE BAYS
- 159 Boats on moorings
  Boats at marinas
- 5 Boat Launch Ramps

NEWCASTLE & PORTSMOUTH HARBOR
- 289 Boats on moorings
- 108 Boats at Marinas
- 2 Boat Launch Ramps

LITTLE HARBOR
- 50-60 moorings
- 1 Boat tied at private pier
- 1 Boat launch ramp
- No marina

RYE HARBOR
- 140 Boats on moorings
- 6 Boats tied at private pier
- 1 Boat Launch ramp
- No marina

HAMPTON & SEABROOK HARBORS
- 180 Boats on moorings at Hampton
- 65 Boats on moorings at Seabrook
- 100 Boat marina in Hampton
- 25-30 Boats in slips at private club in Hampton
- No marina in Seabrook
- 6 Boat launch ramps in Hampton and Seabrook

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Figure S-1 NEW HAMPSHIRE SEACOAST

The purpose of this report is to summarize the findings and conclusions of the recreational boating needs and improvements study for the New Hamsphire coastline. The study covers all the tidal waters of New Hampshire but focuses on the harbor areas with the greatest need and potential for recreational boating improvements. The project was completed by Arthur D. Little, Inc. under the direction of the New Hampshire Port Authority in cooperation with the New Hampshire Office of State Planning; funding was provided by the Federal Coastal Zone Management Program. The objective of the study was to "provide the basis for a comprehensive program for better utilization of the New Hampshire coast with special emphasis on the needs of the recreational boating interests." Based on an analysis of priority needs and sites, the study contains a set of action programs and implementation priorities for recreational boating improvements.

B. Recommended Strategies for Improving Boating Opportunities

The results of our evaluation of five strategies for improving recreational boating opportunities are presented in Table S-2 and Figure S-2:

- Strategy I - Improved Use of Existing Mooring Areas
- Strategy II - Marina/Yacht Club Expansion
- Strategy III - Launch Ramp Improvement/Expansion
- Strategy IV - Development of New or Expanded Mooring Areas
- Strategy V - Development of New Marina Facilities

Table S-2

EVALUATION OF FIVE ALTERNATIVE APPROACHES TO MEETING RECREATIONAL BOATING NEEDS IN NEW HAMPSHIRE HARBOR AREAS

ALTERNATIVES	HARBOR AREAS				
	Hampton/Seabrook	Rye	Little Harbor	Piscataqua/Back Channel	Great & Little Bays
(1) Improved Use of Existing Mooring Areas					
• Need	minor (short waiting list, slow growth)	major (long and growing waiting list)	major (long and growing waiting list)	major (long and growing waiting list)	moderate (some waiting list, slow growth)
• Potential	major (widespacing, unused areas)	minor (already close spacing in all areas)	major (widespacing unused areas)	moderate (some unused areas, some widespacing)	major (widespacing unused areas)
• Constraints	major (silting, low bridge, hazards)	minor (some silting, congestion, wave surge)	minor (multiuse area)	major (limited public access/parking, low bridges, strong currents)	moderate (water and public land
• Costs	moderate (parking, moorings, maintenance dredging)	minor (parking, moorings and realignment)	moderate (new access and parking, moorings)	major (new access and parking, moorings)	minor (access agreements, moorings)
(2) Improvements/Expansion of Existing Marinas & Yacht Clubs					
• Need	moderate (poor conditions but low demand)	-	major (expanding resort and membership)	major (expanding membership, strong demand)	moderate (uncertain demand)
• Potential	moderate (restricted to power boats)	-	major (highly desirable location and access)	major (already being actively considered)	major (most marinas have multiple expansion possibilities)
• Constraints	major (silting, low bridge, hazards)	-	moderate (public access, parking limitations and possible dredging problems)	moderate (strong currents, parking difficulties)	moderate (limited access to ocean)
• Costs	moderate (dredging, repairs, facilities)	-	moderate (significant dredging but project could piggyback on others)	moderate (minimal dredging, new floats, slips)	moderate (minimal dredging)
(3) Improvement/Expansion of Existing Launch Ramps					
• Need	minor (six ramps, limited use)	moderate (one congested ramp)	major (one almost useless ramp)	moderate (two ramps poorly developed)	minor (many ramps limited use)
• Potential	moderate (potential sites include Public Service Pier)	major (double ramp possible at existing site)	moderate (some dredging and new site)	major (physical improvements and parking)	moderate (improvement possibilities)
• Constraints	moderate (silting, hazards, parking)	minor (congestion)	minor (public access through multiuse area at Ordiorne Park)	minor (congestion)	moderate (limited water depths & access to ocean)
• Costs	minor (possible improvements)	minor (improved parking & new ramp)	moderate (some dredging for full tide use)	minor (parking & ramp improvements)	minor (parking and ramp improvements)
(4) Development of New or Expanded Mooring Areas					
• Need	minor (short waiting list, slow growth)	major (long and growing waiting list)	major (long and growing waiting list)	major (long and growing waiting list)	minor (little demand many deep water areas)
• Potential	moderate (many areas with access and some water)	minor (few areas of significant size)	major (one area with public access potential)	moderate (minor in river, power boats only in Back Channel)	moderate (many areas with potential access)
• Constraints	major (silting, low bridge, hazards)	minor (some silting and wave surge)	minor (multiuse area)	major (parking and access difficulties)	minor (water access)
• Costs	moderate (could be coordinated with dredging projects)	major (dredging plus parking and moorings)	major dredging plus parking and moorings)	major (parking, access, dredging and moorings)	moderate (minor dredging, parking and moorings)
(5) Development of New Marina Facilities					
• Need	none (moorings and existing marinas will be adequate)	major (moorings will not provide sufficient density)	moderate (moorings and yacht club may not provide sufficient density)	moderate (moorings and marinas/yacht clubs may not provide sufficient density)	none (moorings and existing marinas or expansions will be adequate)
• Potential	-	major (projects have been considered, backup space adequate)	moderate (backup space adequate, demand strong)	moderate (backup space marginal, demand strong)	-
• Constraints	-	minor (some silting and and wave surge)	moderate (multiuse area)	major (primarily power boats on river and in back channel)	-
• Costs	-	major (dredging, plus parking and new facilities)	major (dredging plus parking and new facilities)	major (dreding or bulkheads plus parking and new facilities)	-

NEW HAMPSHIRE SEACOAST

NEEDS, OPPORTUNITIES & CONSTRAINTS

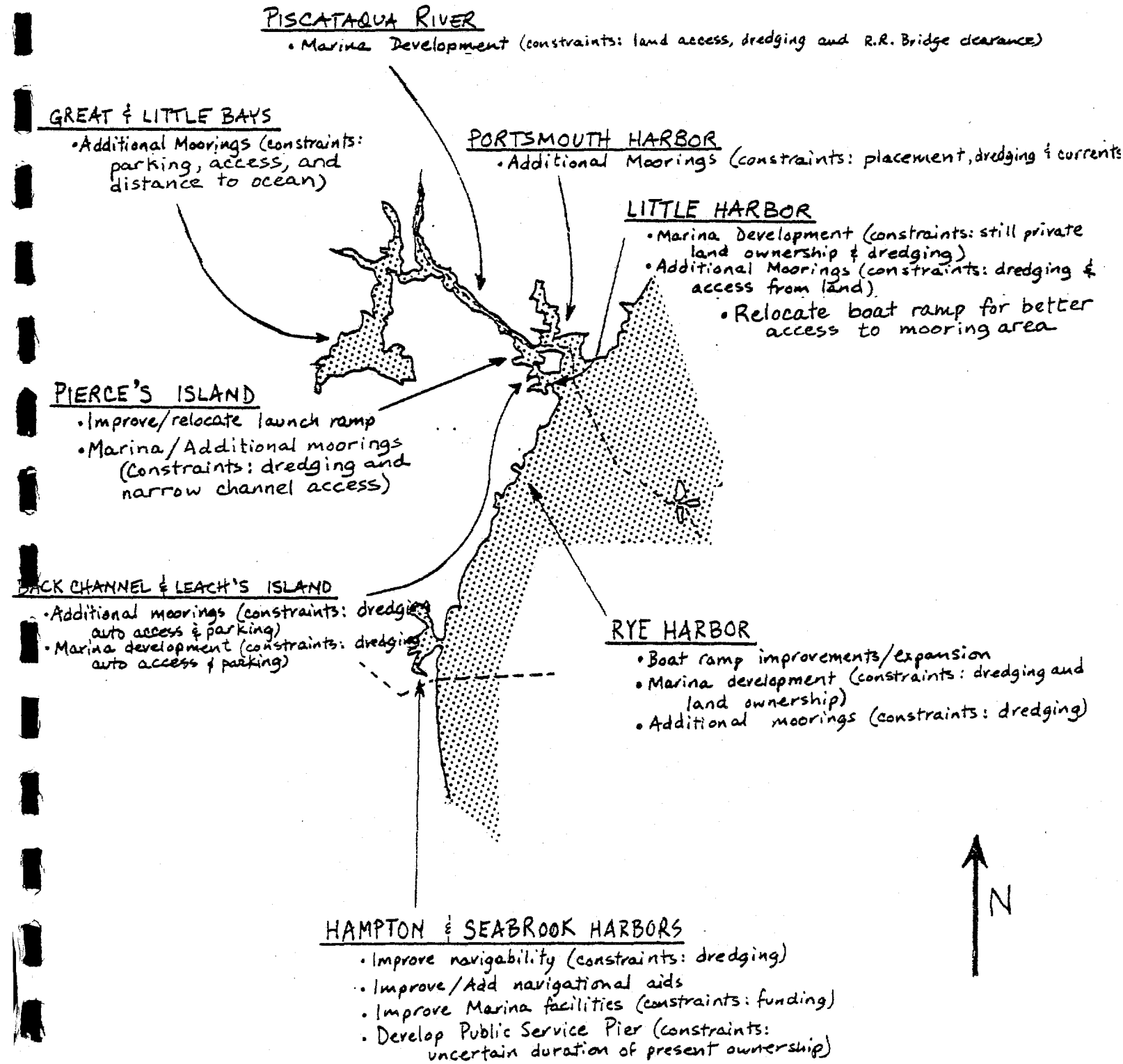


Figure S-2 NEW HAMPSHIRE SEACOAST

The effectiveness of each of these strategies was evaluated in each harbor area in relation to need, potential, constraints and costs. Because of the different boating conditions and needs in different harbors, it was determined that all strategies represent viable approaches, that no one strategy is always the most cost-effective, and that a mix of strategies is likey to be appropriate in different areas.

- In Hampton-Seabrook, it is estimated that existing facilities have adequate capacity to meet most future demands. If needs increase more than anticipated in the near term, the improved use of existing mooring areas (Strategy I) could provide for an additional 40-50 boats at minimal cost. Over the longer term Hampton Marina and mooring expansion (Strategy II and IV) represent cost-effective solutions if greater demands were to develop. Maintenance dredging and the reuse of the public service pier (possibly for relocated commercial fishing facilities) represent continuing needs.

- In Rye Harbor, the single launch ramp is frequently congested, and there is a waiting list of 146 names for moorings. The addition of a second launch ramp to provide in and out capability (Strategy III) is recommended for the near term. Because of the currently high density of moorings (9 per acre), only 10-20

additional moorings could be added through near-term mooring realignments (Strategy I). The development of new marina facilities (Strategy V) is recommended as the most cost-effective way to substantially expand boating opportunities and meet long-term needs in this harbor.

- In Little Harbor, the existing launch ramp is virtually unusable, and there is a 142 name waiting list for moorings in the Little Harbor/Portsmouth area. Because existing deepwater areas are so poorly utilized due to poor access (a density of 2 boats/acre) the relocation of the launch ramp and the improved use of existing mooring areas (Strategy I and III) is recommended for immediate implementation. Over the longer term, development of a new marina facility (Strategy V) will be the most cost-effective way to meet boating needs. Incorporation of such a facility into the Wentworth Hotel's Development Program would probably be the most effective, although a marina off Fort Dearborn is also a possibility.

- In the Piscataqua River and Back Channel Areas, there is currently a 142 name mooring waiting list, constraints vary greatly, and there are several ways to expand boating opportunities. Because of the limited possibilities on the Piscataqua River, and because of the underused deepwater areas in the Back Channel, we have recommended that a combination of Strategies I and IV be pursued in the near

term. We have recommended that access and parking be provided to an unused large deepwater area behind Goat Island and that moorings be realigned to concentrate all powerboats in this mooring area. This would allow sailboats to have better access to the Piscataqua River and Little Harbor moorings not constrained by bridges. Expansion of the Portsmouth Yacht Club or other marina facilities represent longer-term possibilities.

- In the Great and Little Bay areas, it is estimated that existing facilities are capable of meeting most near-term demands. Improved use of existing mooring areas through access agreements with marinas (Strategy I) is recommended for near-term implementation. Marina expansions offer additional opportunities should demands continue to increase.

C. Recommended Recreational Boating Improvements and Action Plans

Each of the 23 identified alternatives was first analyzed in relation to marine engineering, environmental and access factors to determine relative physical feasibility as shown in Table S-3. The alternatives were then analyzed in relation to economic and financial considerations. All alternatives selected were found to be physically feasible but the costs per boat to develop each alternative varied from $700 to $16,000 per additional boat. Based on our analysis of these factors and an assessment of the relative needs in each harbor area, we have recommended the two phased improvement program summarized below.

TABLE S-3
IDENTIFIED BOATING IMPROVEMENT POSSIBILITIES
AND SITES NEW HAMPSHIRE COASTLINE

Harbor Area Site	Type of Improvement	Area Covered	Capacity
Rye 0 West End	improved parking, improved in and out launch ramps	1.0 acres of improved parking 13.5 acres of existing moorings	73 cars, 40 boat trailers, 2 ramps, 146 existing moorings
Rye I (including 0) Entire Harbor	expanded parking, realigned moorings	0.1 additional acres of parking	146 existing moorings, 18 moorings added for total of 164 moorings, 9 additional cars
Rye II (including 0, I) Southwest Corner	permanent party boat facilities	0.1 additional acres of parking	3 new slips, 9 moorings added to 164 moorings from Phases 0 and I for total of 173 moorings, 5 additional cars
Rye III (including 0, I, II) Northwest Corner	improved revetment, dredging, new marina development and parking	2.0 additional acres of parking 7.9 additional acres of slips	283 new slips, 173 moorings (from Phases 0, I, and II) 283 additional cars
Rye IVA (including 0, I, II, III) Southwest Corner	dredging, parking and expanded mooring area	0.2 acres of parking 5.1 additional acres of moorings	123 existing moorings, 44 additional moorings, 22 additional cars
Rye IVB (including 0, I, II, III) Southwest Corner	dredging, parking new revetment, and marina	2.0 additional acres of parking 7.1 additional acres of slips	287 additional slips, 147 remaining moorings 274 additional cars

TABLE S-3
IDENTIFIED BOATING IMPROVEMENT POSSIBILITIES
AND SITES NEW HAMPSHIRE COASTLINE (CONTINUED)

Harbor Area Site	Type of Improvement	Area Covered	Capacity
Little Harbor 0 Fort Dearborn	relocate launch ramp and parking new pier/float access	0.5 acres of parking 27 acres of existing moorings	25 cars and 10 car/trailers 1 ramp, 50 existing moorings
Little Harbor I (including 0) Central Harbor and Fort Dearborn	expanded parking, realigned moorings	1.0 additional acres of parking 27 acres of existing and additional moorings	50 existing moorings, 100 to 139 moorings added for total of 150 to 189 moorings 70 additional cars
Little Harbor II (including 0, I) Wentworth Pier	dredging, expansion piers and floats, expanded parking	1.5 additional acres of parking 5.9 acres of slips	183 new slips, 189 moorings (Phase 0, I high end of range) 185 additional cars
Little Harbor III (including 0, I, II) Wentworth Golf Course	dredge and fill new piers and floats expanded parking	2.5 additional acres of parking 10.9 additional acres of slips	337 additional slips, 189 remaining moorings (Phase 0, I, and II) 337 additional cars
Little Harbor IV (including 0, I, II, III) South Side and Fort Dearborn	dredging, expanded parking new piers and floats	2.6 additional acres of parking 8.4 additional acres of slips 14.7 additional acres of moorings	224 additional slips, 102 additional moorings plus 189 moorings (Phases 0, I, and II) for total of 291 moorings 275 additional cars
Piscataqua I Newcastle/ Goat Island	improved parking, realigned moorings	0.1 acres of parking 264 existing moorings 18.0 acres of existing and expanded moorings	15 additional cars, 30 additional moorings for total of 294 moorings

TABLE S-3
IDENTIFIED BOATING IMPROVEMENT POSSIBILITIES
AND SITES NEW HAMPSHIRE COASTLINE (CONTINUED)

Harbor Area Site	Type of Improvement	Area Covered	Capacity
Piscataqua II Newcaslte-Portsmouth	expanded piers, floats, expanded parking	1.0 additional acres of slips 0.3 additional acres of parking	30 additional cars, 23 existing plus 30 additional slips for total of 53 slips
Piscataqua III Pierce Island	new revetments, floats piers, parking	5.2 additional acres of slips 1.8 additional acres of parking	243 new cars, 243 new slips plus 53 existing slips (Phase II) for total of 296 slips
Piscataqua IV Gypsum Cove	new parking, access, and floats	3.0 additional acres of moorings 0.3 additional acres of parking	52 additional moorings, 26 additional cars
Hampton-Seabrook I Entire Harbor	realigned moorings, expanded parking	41.0 acres of existing moorings	245 existing moorings, 45 additional moorings, for total of 290 moorings 23 additional cars
Hampton-Seabrook II (including I) Hampton Marina	improved marina and parking	3.0 acres of slips 3.2 existing acres of parking	130 existing slips
Hampton-Seabrook III (including I, II) Hampton and Seabrook Piers	relocate fishing facilities and floats, expand mooring areas and marina with dredging	20 additional acres of parking 3.0 additional acres of moorings 1.5 additional acres of slips	290 existing moorings (Phase I) plus 20 additional moorings, for total of 310 moorings, 60 additional cars, 130 existing slips plus 50 new slips for total of 180 slips

TABLE S-3
IDENTIFIED BOATING IMPROVEMENT POSSIBILITIES
AND SITES NEW HAMPSHIRE COASTLINE (CONTINUED)

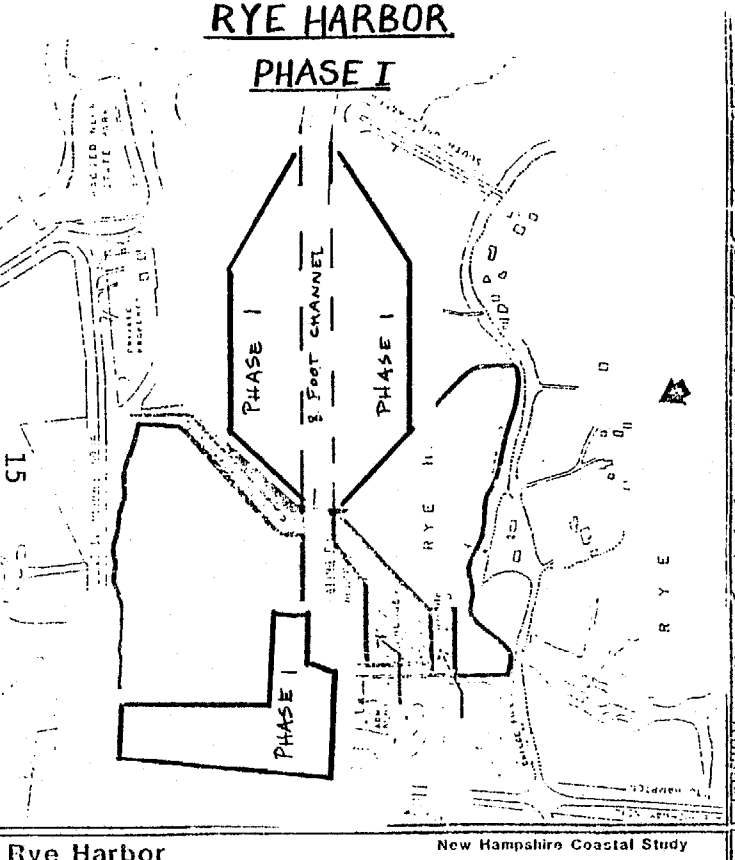
Harbor Area Site	Type of Improvement	Area Covered	Capacity
Back Channel I Goat/Pest Island	dredge and fill for new parking, floats/outhauls	0.7 acres of additional parking 16.6 acres of additional moorings	5 existing moorings, plus 134 to 186 additional moorings, for total of 139-191 moorings, 93 additional cars
Back Channel IIA Leaches Island	new causeway, parking, pier and dredging	0.8 acres of additional parking 14.5 acres of additional moorings	191 moorings (Phase I, high range) plus 201 additional moorings, for total of 293 moorings 100 additional cars
Back Channel IIB Leaches Island	new causeway, parking, pier, floats and dredging	3.5 acres of additional parking 7.3 acres of slips	482 new slips 482 additional cars
Great Bay I Great Bay	access and parking for additional moorings and realignment	0.4 acres of improved parking 18.0 acres of existing moorings	159 existing moorings, plus 100 additional moorings, for total of 259 moorings 50 cars
Great Bay II Great and Little Bays	marina expansion		125 existing slips, plus 100 additional slips for total of 225 slips

Phase I

For the first three years (Phase I: 1981-1983) we have recommended full implementation of approximately $600,000 worth of recreational boating improvements consisting largely of improved access and parking for realigned moorings in existing deepwater areas of Rye Harbor, Little Harbor and behind Goat Island in Portsmouth/New Castle (as shown in Figure S-3). These three major projects combined with minor realignments and improvements in Great Bay and Hampton/Seabrook would provide a total of an estimated 518 additional permanent moorings on the New Hampshire coastline--accommodating approximately 45-60% of the estimated additional 1985 need for these facilities. It is recommended that the total cost of these improvements be financed by private investment of $233,000 (for mooring tackle, etc.) by $179,000 of state issued tax exempt revenue bonds financed primarily by mooring fee increases of $10 to $25 per year, and by $186,000 of state funded public improvements (for access improvements and part of the parking). We also recommend initiation of design and engineering work on at least two new privately operated marinas, one in the northwest corner of Rye Harbor and one at the Wentworth Hotel and of possible marina expansion at Portsmouth Yacht Club or Hampton Marina.

This strategy is recommended as the first phase because of its relatively low cost per boat and minimal environmental disruption. However, if saltwater boating needs continue to increase as anticipated, there will soon not be enough deepwater areas to meet boating needs through low density moorings at 4 to 10 boats per acre. Since high density moorings (e.g., bow and stern)

RYE HARBOR
PHASE I

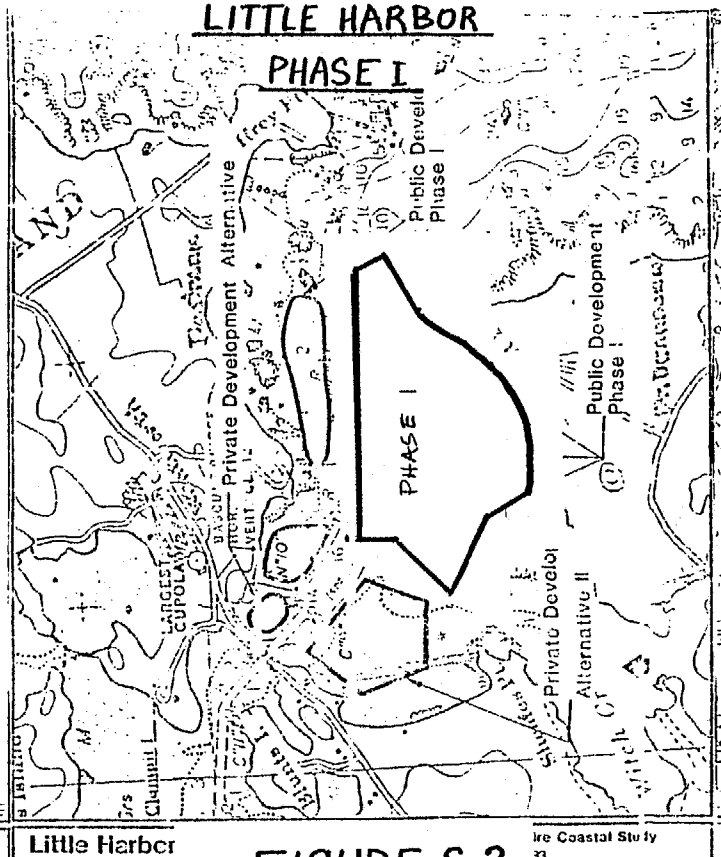


Rye Harbor
Development Phases

Sasaki Associates, Inc.
64 Pleasant Street, Watertown, Mass. 02172
Planning · Architecture · Landscape Architecture
Civil Engineering · Environmental Services

New Hampshire Coastal Study
Project No. 0183
Drawn By J.L.
Checked By C.G.S.
Approved By R.T.W.
Drawing Date 3/23/81
Sheet Number A-1
Scale 1"=331'

LITTLE HARBOR
PHASE I



Little Harbor
Development I

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Civil Engineering · Environmental Services

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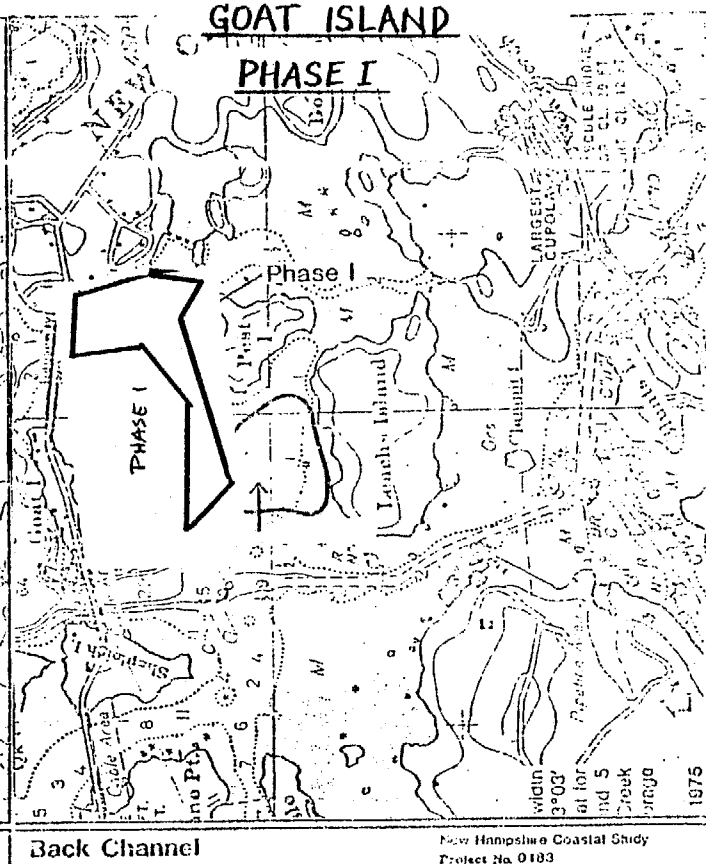
Scale 1"=300'

FIGURE S-3

GOAT ISLAND
PHASE I



Back Channel
Leachs Island Development Phases

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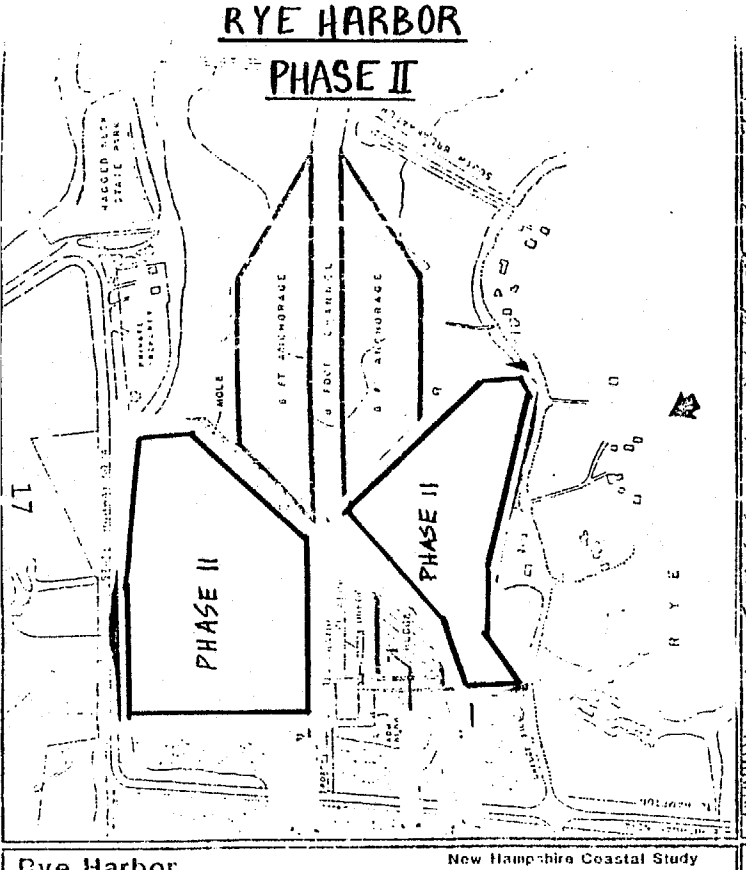
Sheet Number A-13
Scale 1"=600'

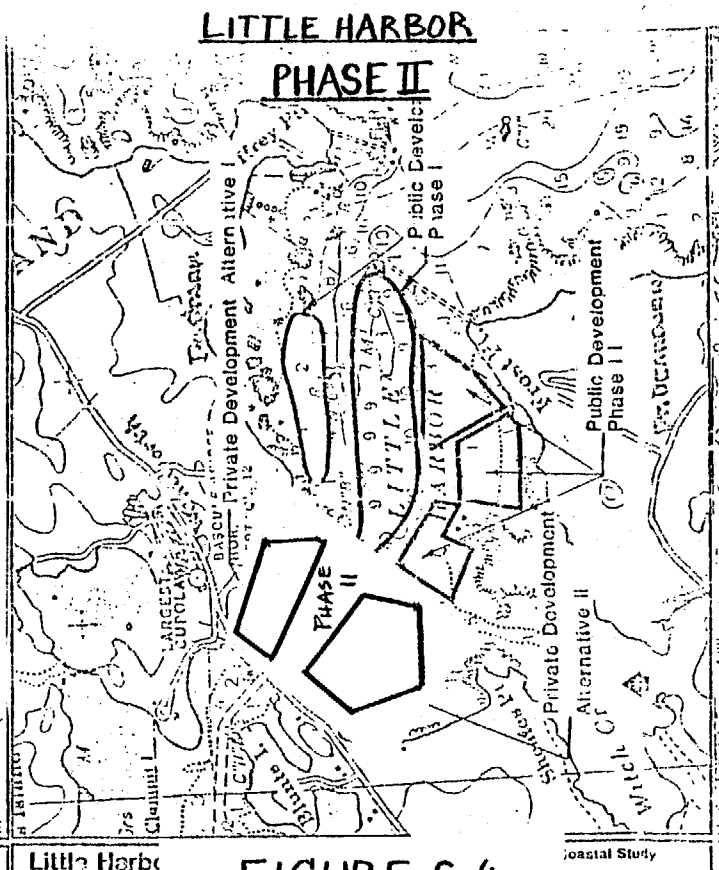
are not feasible given the currents, tidal range and exposure of coastal harbors in New Hampshire, other actions will be necessary in Phase II.

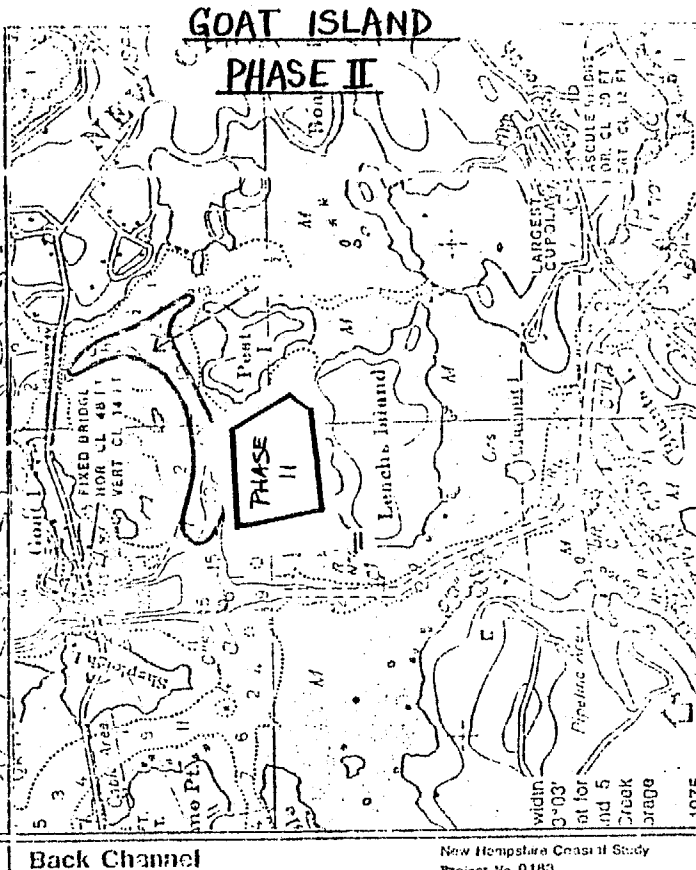
Phase II

For the second three years (Phase II: 1984-1987), we have recommended implementation of the marine developments and expansions initiated in Phase I--assuming the needs continue to grow sufficiently to justify construction of these facilities at that time (illustrated in Figure S-4). These facilities and associated dredging and marine safety improvements would cost an estimated $3.7 to $4.8 million (in 1980 dollars) or $6,000 to $7,000 per boat. While these costs are high, they are substantially below the $10,000 to $15,000 per boat that it might cost to dredge new low density mooring areas. Because of these relatively high dredging and construction costs, dependence on private financing for marinas will preclude the feasibility of such facilities unless boaters can afford and are willing to pay yearly slip rental feels in excess of $50 per foot to repay construction costs alone. However, if such expanded marina facilities do not get built, the pressure on existing mooring areas and waiting lists would become extreme, and many boaters would not be able to meet their boating needs within the state.

Also in Phase II, it is likely that the Public Service Pier will become available for use by the Town of Seabrook or by the State. Consideration and evaluation of possible alternative developments at this site should be initiated as early as possible.







Rye Harbor Development Phases Sasaki Associates, Inc. 64 Pleasant Street, Watertown, Mass. 02172 Planning · Architecture · Landscape Architecture Civil Engineering · Environmental Services	New Hampshire Coastal Study Project No. 0183 Drawn By J.L. Checked By C.G.S. Approved By R.T.W. Drawing Date 3/23/81 Scale 1"=320' Sheet Number A-1	**Little Harbor** Development Sasaki Associates 64 Pleasant Street, Watertown, Mass. 02172 Planning · Architecture · Landscape Architecture Civil Engineering · Environmental Services Drawing Date 3/23/81 Scale 1"=300' Sheet Number A-7

FIGURE S-4

Back Channel Leachs Island Development Phases Sasaki Associates, Inc. 64 Pleasant Street, Watertown, Mass. 02172 Planning · Architecture · Landscape Architecture Civil Engineering · Environmental Services	New Hampshire Coastal Study Project No. 0183 Drawn By J.L. Checked By C.G.S. Approved By M.F. Drawing Date 3/23/81 Scale 1"=200' Sheet Number A-13

We have, therefore, recommended that an estimated $376,000 to $790,000 be funded by state issued tax exempt revenue bonds. These bonds would be backed by lease revenues equivalent to an estimated $350,000 to $450,000 per year or about $600 per additional slip per year. These improvements would accommodate an estimated 575-729 slips and together with existing facilities and the Phase I improvements could, therefore, accommodate 80-90% of the estimated 1990 needs.

Recommended Action Plan

In order to implement the recommended strategies and two-phase improvement program for recreational boating on the New Hampshire coastline, we recommend that the Port Authority and the State of New Hamsphire pursue the following six point action program.

1. Establish a special improvement fund for recreational boating with revenues accruing from specially dedicated mooring fees, launch ramp fees, parking fees, etc. associated with recreational boating.

   - Obtain authorizing legislation to use this fund for funding or financing all or part of the following types of recreational boating improvements--parking areas, launch ramps, dinghy docks and storage, revetments, breakwaters, and dredging for recreational boats.

- Obtain authorizing legislation to pledge revenues from this fund to back tax exempt revenue bonds to be issued by the Port Authority or State of New Hampshire. Such authorizing legislation should also provide for revenue bond financing of marina improvements.

- Adopt a new annual fee schedule of $2 per foot for mooring permits. All fees in excess of $15 per year would be dedicated to the special capital improvement fund for recreational boating. Annual non-resident fees should also be established at $5 per foot.

- Adopt a parking fee or permit schedule for special parking/access facilities at Fort Dearborn, Rye Harbor, Goat Island, Hampton and other facilities which may be developed. This permit/fee schedule should be equivalent to $10 per year or $1 per use ($4 per use for cars with trailers). The permit and special sticker program could be administered by either the Port Authority or DRED with enforcement and collection of use fees administered by DRED. Following payment of required fees to DRED all remaining permit and use fees should be dedicated to the special capital improvement fund for recreational boating.

2. Adopt a six year capital improvement program providing for recreational boating improvements and additional mooring/marina capacity for 1000 to 1200 boats.

- After public review and Port Authority consideration of the evaluation and prioritization of improvements in this report, a capital improvement program should be adopted by the Port Authority reflecting a realistic assessment of needs, opportunities, constraints and financial resources.

- After adoption by the Port Authority, the capital improvement program for recreational boating should be incorporated by other agency programs (e.g., OSP, SCORP, DRED and Public Works and Highways).

- Annually revise the capital improvement program to reflect changing needs, opportunities, constraints, and financial resources.

- Annually update the needs assessments based on waiting list information and updated data on population and boat registrations.

3. Adopt a set of mooring equipment, alignment and management standards to be followed by the harbor masters and recreational boaters.

- Alignment standards should be established in officially designated mooring areas with public access and should reflect the specific depths and tidal range of the area with spacing being additionally determined by the length of boat.

- Equipment standards should be adopted which reflect the need in higher density mooring areas to assure stable moorings and secure tackle. Anchor weights varying by material (because of varying displaced weights) and type (e.g., granite blocks vs. mushroom anchors) should be adopted and mooring tackle should be inspected regularly to assure adequate size and condition.

- Mooring management standards should be adopted which establish clear rules for waiting list administration. People abandoning moorings should be given priorities on future waiting lists but long-term mooring rentals or vacancies should not be permitted. A mooring plan for each harbor area should be maintained showing the location of each mooring, the size of boat, and the swing radius (based on tidal range, boat length, and tackle).

4. Proceed immediately with priority improvement projects in an intensive effort to adequately accommodate all boaters who have been on mooring waiting lists.

- Proceed with realignment of moorings in Rye Harbor, Little Harbor, and on the Piscataqua River, increasing the densities and assuring that the deepest waters are reserved for deep-draft boats with powerboats being assigned to shallower waters.

- Harbor masters should submit an alignment plan to the Port Authority for administrative authorization consistent with standards adopted in Recommendation #3.

- Relocate the Witch Creek Launch Ramp to the other Fort Dearborn location that would provide suitable access to the existing Little Harbor mooring area. Provide for limited immediate parking (possibly unimproved).

- Initiate specific programs at Fort Dearborn (with DRED), at Goat Island (with Department of Public Works and Highways) and at Rye Harbor (with DRED) to assure adequate access and parking improvements as soon as possible in these areas.

5. Enter into agreements with appropriate agencies and commercial facilities in order to accommodate and facilitate plan implementation, including the following:

- With DRED to provide access through Ordiorne State Park and allow capital and management improvements at Rye Harbor (parking lot and land use), Hampton Harbor (State Pier parking lot) and Ordiorne State Park (ramp, parking lot and other improvements).

- With State Department of Public Works and Highways for access and development of parking facilities adjacent to Goat Island Causeway.

- With private marine operators (e.g., Great Bay Marina) for improvements and expansion of facilities and increased mooring access.

6. Adopt a long-range strategy for improving recreational boating on the New Hampshire coastline.

- The Port Authority should adopt a long-range strategy for improving recreational boating, incorporating the material developed in this study and reflecting policy and program recommendations developed as a result of public review of this study.

- This strategy should be coordinated with DRED plans for coastal areas, reflecting the need to accommodate mixed use with minimal conflicts. The Office of State Planning should endorse and support its incorporation in other State agency plans and programs.

D. Study Findings

The other principal findings of the study are summarized below under the four headings of (1) facilities and resources, (2) needs, (3) constraints and opportunities, (4) feasibility.

1. Recreational Boating Facilities and Resources

There are seven principal concentrations of recreational boating activity along the New Hampshire coast, each area having significantly different physical characteristics, boating facilities, and boating use. These differences are summarized in Table S-4.

- Physical Characteristics - Water depths and bridge clearances represent critical physical constraints in Seabrook, Hampton, Back Channel, and Great and Little Bay, while currents and other boating hazards are important constraints along the Piscataqua and at Hampton/Seabrook. Public access is most limited at Little Harbor, the Back Channel, and Great and Little Bays.

- Boating Facilities - Marina slips and docks accomodate approximately 450 boats along the New Hampshire coastline with major concentrations of facilities on the Piscataqua River and in Hampton, the Back Channel, and Great and Little Bay. Moorings accommodate an additional 900 boats with the largest concentrations at Hampton, Rye and New Castle. There are about 16 boat launch ramps along the coast accommodating about 10,000 launches a year with the heaviest use at Rye and Pierce Island.

- Boating Use - Commercial fishing boats are most heavily represented in Seabrook, Rye and Pierce Island; sailboats are most heavily

Table S-4

Harbor Area	# Moored Boats	Type of Boats Accomodated in 1980 (% of total) Power	Sail	Waiting List - 1980 #	Boat Ramps	# Slips	Constraints to Expanded Opportunities: Water Depths	Public Access/ Parking	Bridge Clearances	Currents Rocks, and Other Hazards	Sensitive Areas
Seabrook	65	98	2	38	3	0	major	minor	major	major (rocks)	minor
Hampton	180	90	10[a]	47	3	130	major	minor	major	major (rocks)	minor
Rye	142	65	35	146	1	6	major	minor	none	none	minor
Little Harbor	60	2	98	142[b]	1	1	minor	major	none	none	moderate
Back Channel	80	90	10	142[b]	0	85	minor	major	major	none	moderate
Piscataqua	183	35	65	142[b]	2	23	minor	moderate	minor	major (currents)	minor
Great & Little Bays	159	40	60	26	5	128	minor	major	moderate	minor	moderate

[a] Includes sailboats offshore at Plaice Cove.

[b] Little Harbor, Back Channel and Piscataqua River have a combined waiting list of 142.

represented at Rye, Little Harbor and New Castle and other recreational powerboats are most concentrated in Hampton, Rye, the Back Channel and Great and Little Bays.

2. Recreational Boating Needs

Recreational boating needs along the New Hampshire coast have been increasing rapidly in recent years and are forecast to continue this increase as a result of increasing population, income, and boat ownership in Southeast New Hampshire. The demands on recreational boating facilities have increased substantially and long waiting lists for moorings are now common. Table S-5 summarizes our estimates of recent trends and forecasts of population and boating activity.

- Population - The population and number of households in Southeast New Hampshire have grown at an annual rate of 3.3% and 4.4% over the past decade. These growth rates are two to three times the growth rates of the U.S. as a whole and of the states of Massachusetts and Maine. Growth is expected to continue to exceed the national average but to slow to 1-3% per year over the next 20 years.

- Income - Average household income growth in Southeast New Hampshire has also exceeded the national average and a continuing influx of younger dual income households is expected to maintain this trend.

Table S-5

Recreational Boating In the Tidal Waters of New Hampshire
Existing and Anticipated Demands for Permanent Slips or Moorings

Demand Components	All Tidal Waters of N.H.
1. 1980 Moorings/Slips	1253
2. 1980 Mooring Waiting List	257
3. Additional Estimated 1980 Needs	200
4. Increased Needs 1981-1985	400-700
5. Increased Needs 1986-1990	300-600
Total Additional Needs to 1990 (2 + 3 + 4 + 5)	1200-1700
TOTAL NEEDS	2500-3000

- Boat Ownership - Coast Guard boat registrations for New Hampshire (primarily for saltwater but including some interstate waters) have doubled since 1972, increasing at a rate of about 8% per year for the last five years. National boat ownership trends have also increased from 43 per thousand people in 1970 to 53 per thousand people in 1979.

- Facility Utilization - Mooring area use in saltwater areas of New Hampshire has increased from approximately 200-300 moorings in 1966-1967 to an average of 850-1000 over the last three years.

- Waiting Lists - Mooring waiting lists have existed at all New Hampshire boating areas during the last few years with the longest 1980 lists at Rye Harbor (146) and Portsmouth/New Castle (142). Long waiting lists also exist for nearby areas in Kittery, Maine and Newburyport, Massachusetts.

We have estimated that demands for permanent slips and moorings will increase from an estimated 1700 in 1980 to 2100-2400 in 1985 and 2400-3000 in 1990. This represents a growth rate of 3.5% to 6% per year.

3. Recreational Boating Constraints and Opportunities

The greatest physical constraints to improved recreational boating opportunities are the limited number of safe deepwater areas with unimpeded access to the

ocean or other boating areas, and the limited public access and parking to serve these areas. Most existing deepwater areas with good public access are fully used. Increased recreational boating opportunities in these areas (e.g., in Hampton/Seabrook and Rye) are primarily dependent upon better mooring management or alignments and/or marina development or expansion. Shallower waters with good public access exist at Hampton/Seabrook and at Rye and would require dredging to increase boating opportunities. Deepwater areas without good public access exists at Little Harbor, Great and Little Bay and in the Back Channel area and these areas would require the acquisition, development or improvement of public access to increase boating opportunities.

Wetlands, sensitive habitat areas, and other environmental factors also limit the boating potential of some areas and numerous specific sites. Based on our evaluations of expanding boating needs and these physical and environmental constraints, we investigated the degree to which boating potential could be improved in each of the seven harbor areas under the following five strategies:

- better utilization of existing deepwater areas;
- improvement/expansion of existing marina and yacht club facilities;
- improvement/expansion of existing launch ramp facilities;
- development of new or expanded deepwater mooring areas; and
- development of new marina facilities.

As a result of these investigations of 23 specific projects and several sites for improving boating opportunities were identified as shown in Table S-3.

Where land and water access problems can be overcome, the boating potential of existing or new deepwater areas will be a function of the densities that can be achieved through alternative mooring and marina configurations. The greatest potentials for overcoming physical constraints and expanding recreational boating opportunities within environmental limits exist in Rye and Little Harbors (for both sail and powerboats), and in the Back Channel and Great and Little Bays (principally for powerboats). Because of strong currents, bridges, and other boating hazards, there are relatively fewer opportunities in Hampton/Seabrook and along the Lower Piscataqua River.

4. The Feasibility of Expanded Recreational Boating Facilities

Because recreational boating improvements can be designed and sited to overcome the physical and environmental constraints identified, the feasibility of increasing recreational boating opportunities will be a function of both the construction standards and costs and the financing mechanisms utilized While numerous construction standards and financing mechanisms were investigated in this study, the following construction cost and financing assumptions were used as a basis for assessing feasibility:

- Parking - gravel parking areas with 1 space per 2 moorings, 1 space per slip, and 1 car and trailer space per peak day launch were assumed to cost $325 per car space and $487 per car/trailer. Public parking was assumed to be 50% financed

by state for federal grants and 50% by revenue bonds backed by parking fees. Private marina parking was assumed to be eligible for revenue bond financing backed by user fees.

- Moorings - new moorings were estimated to cost an average of $400 per boat and realignments/upgrading were estimated to cost an average of $100 per boat with all costs privately financed.

- Dredging - dredging costs were estimated at $6 to $8.50 per cubic yard plus $35,000 for dredge mobilization, with costs financed by state or federal grants for channels and with costs financed by revenue bonds backed by user fees for mooring areas or marinas.

- Floats and Piers - floats and piers were estimated to cost an average of $16 per square foot with construction costs eligible for revenue bond financing backed by user fees or lease revenues.

- Public Access Roads and Launch Ramps - public access improvements were assumed to be financed by state/federal grants.

- Revetments and Breakwaters - revetments were assumed to cost $300 to $400 per lineal foot and breakwaters $1500-$2000 per lineal foot depending on the site conditions. Breakwaters were assumed to be 50% financed by state/federal grants and 50% by revenue bonds backed by user fees. Revetments were assumed to be financed by

state/federal grants where they were on state land and by revenue bonds backed by fees or lease revenues where they were associated with private marina development.

These cost and financing guidelines were based on our assessment of evolving and uncertain federal/state assistance programs and the need to establish a realistic and achievable implementation program. Consequently, the assumptions involve a much greater dependence on user fees and low interest revenue bonds than on direct state/federal grants. Based on these assumptions the cost and financing implications of the projects were assessed as illustrated in Table S-4. It was estimated that improved facilites for existing boaters plus an additional 518 moorings could be feasibly provided at appropriate locations at a cost of about $600,000 with $200,000 from state/federal grants, with 190,000 supported by additonal parking and mooring fees equivalent to $15-$20 per year for all moorings, and with $235,000 privately financed.

It was also estimated that facilities for an additional 600-700 boats (primarily marinas) could be feasibly provided at a cost of $3.7 million--with $400,000 to $900,000 from state/federal grants and with the remainder financed by bonds supported by fees equivalent to $500 to $600 per marina slip.